# DoD Stationary Fuel Cell Demonstration Program

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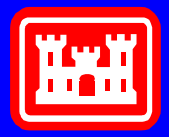
DER for Federal Facilities Workshop
Atlanta, GA
April 23, 2002



# Fuel Cells

Fuel cells are electrochemical power generators with the potential for attaining very high electrical energy conversion efficiencies while operating quietly with minimal polluting emissions. In addition, by-product thermal energy generated in the fuel cell is available for use for cogeneration of hot water or steam.

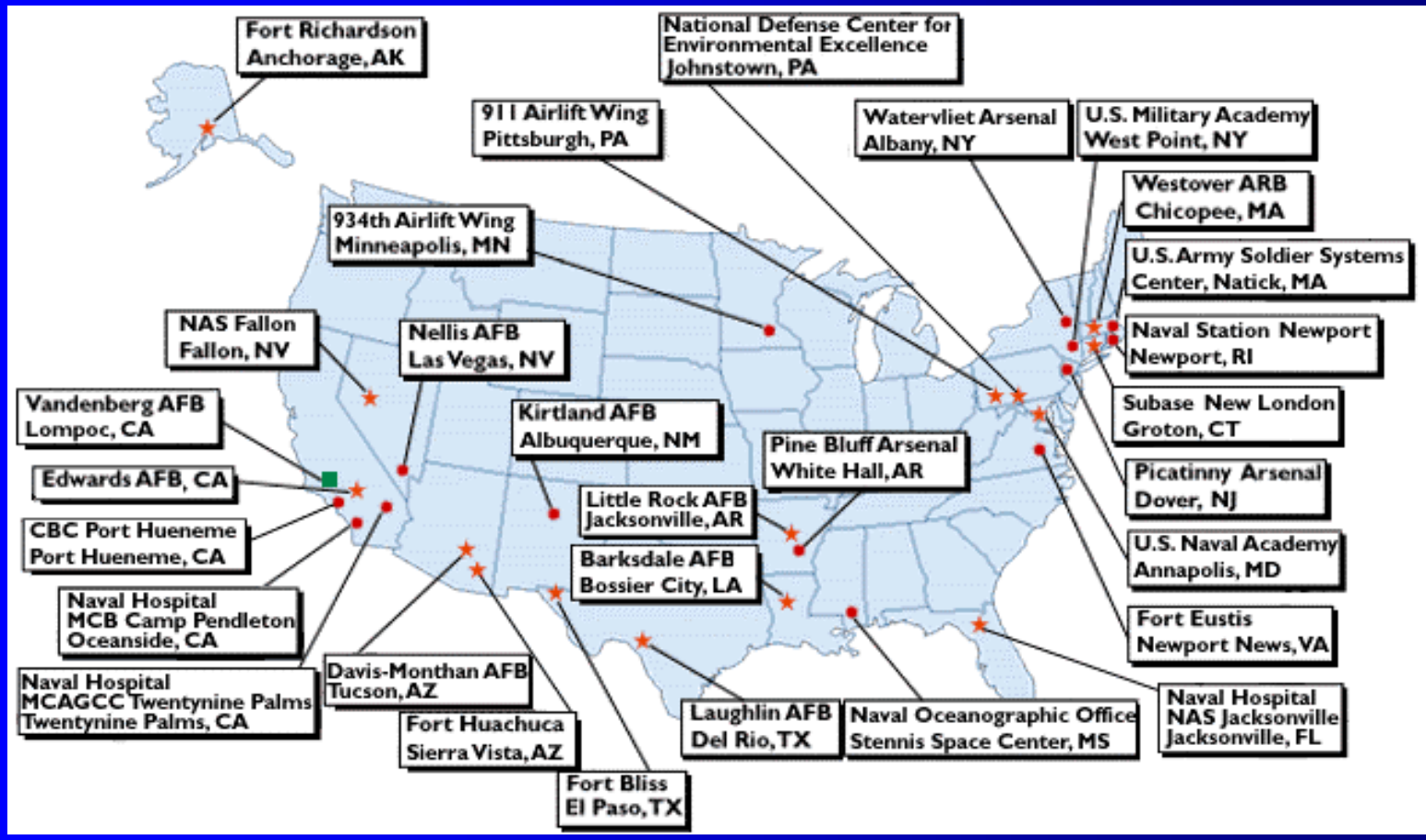
# DoD PAFC Demonstration Program

- DUECC Request for CERL Assistance
- FY93 Congressional Appropriation - $18M
- FY94 Congressional Appropriation - $18.75M
- Specify “...natural gas fuel cells in production in the United States...”

# Turn-key Package

- IFC PC25 Fuel Cell Power Plant
  - Fy93 - 1 ea. Model A, 11 ea. Model B
  - Fy94 - 3 ea. Model B, 15 ea. Model C
- Engineering Design / Installation
- Training for Site Personnel
- 60 Months Maintenance
- Diagnostic / Remote Monitoring Computer

# DoD PAFC Program Sites

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# DoD PAFC Facility Applications

- **Central Heat Plants**

  **11 Sites**

- **Hospital Utility Plants**

  **7 Sites**

- **Pool / Gymnasiums**

  **3 Sites**

- **Others**

  **Barracks, Dining Facility, Laundry, NG Armory, Launch Control Bldg., Office, Evaporator process**

# FY93 Program Sites

934th Airlift Wing, Minneapolis MN

Kirtland AFB, Albuquerque NM

Nellis AFB, Las Vegas NV


Vandenberg AFB, Lompoc CA

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# FY93 Program Sites

Naval Hospital, MCAGCC 29 Palms, 29 Palms CA

Naval Hospital, MCB Camp Pendleton, Oceanside CA

Naval Education Training Center, Newport RI


US Naval Academy, Annapolis MD

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# FY93 Program Sites

U.S. Army Soldier Systems Command, Natick MA

Ft. Eustis, Newport News VA

Picatinny Arsenal, Dover NJ

U.S. Military Academy, West Point NY

# FY94 Program Sites

911th Airlift Wing, Pittsburgh PA

NAS Fallon, Fallon NV

Ft. Richardson, Anchorage AK

Naval Hospital, NAS Jacksonville, Jacksonville FL

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# FY94 Program Sites

Edwards AFB, CA

Barksdale AFB, Bossier City LA


Ft. Huachuca, Sierra Vista AZ


National Defense Center for Environmental Excellence (NDCEE), Johnstown PA

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# FY94 Program Sites


CBC Port Hueneme, Port Hueneme CA

Laughlin AFB, Del Rio TX

Naval Oceanographic Office
John C. Stennis Space Center, MS


Westover ARB, Chicopee MA

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# FY94 Program Sites


Ft. Bliss, El Paso TX


Subase New London, Groton CT

Little Rock AFB, Jacksonville AR

Pine Bluff Arsenal, White Hall AR

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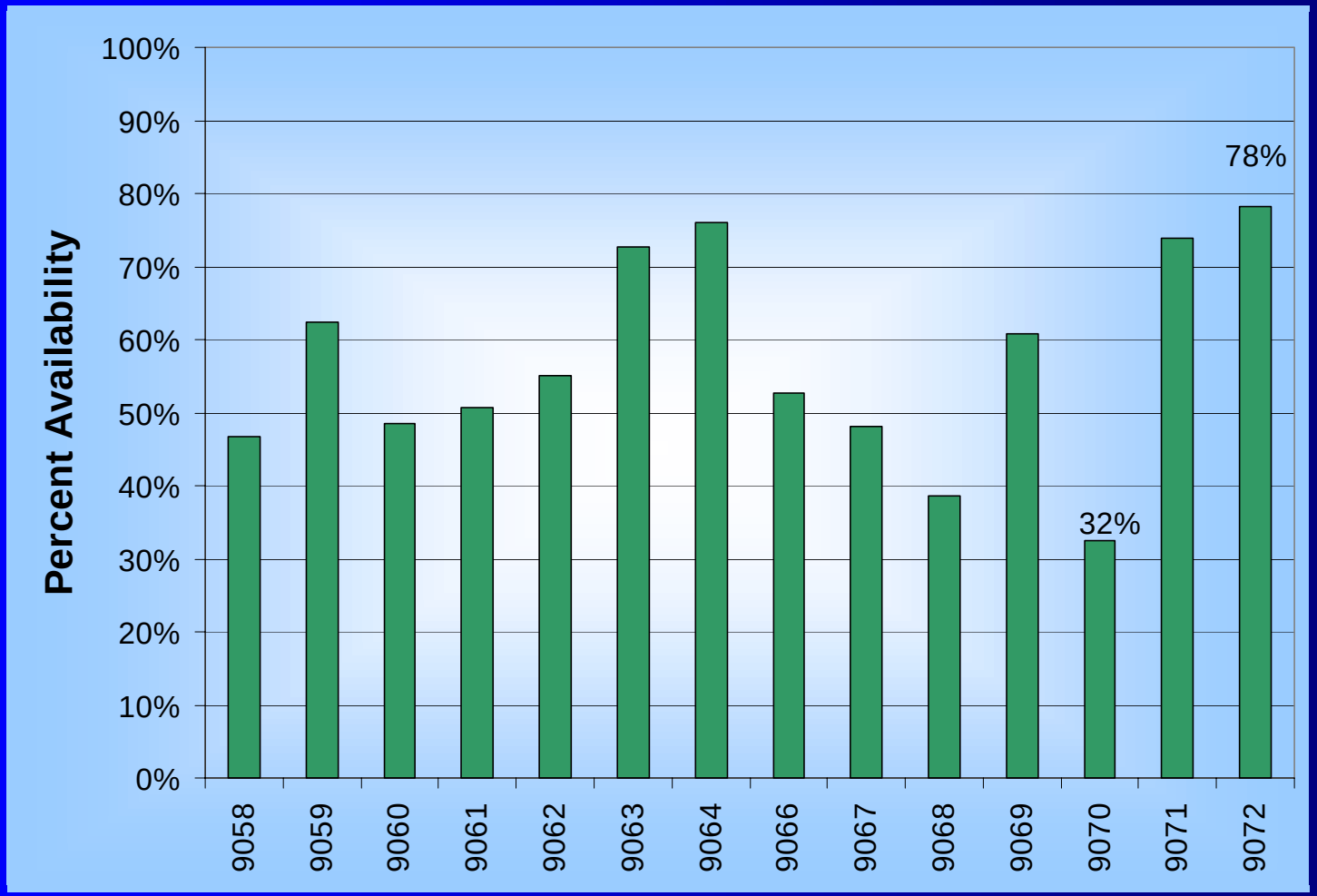
# FY94 Program Sites

Watervliet Arsenal, Albany NY

Davis-Monthan AFB, Tucson AZ

# PC25B Availability

## Lifelong Average for 14 Sites as of 3/31/02

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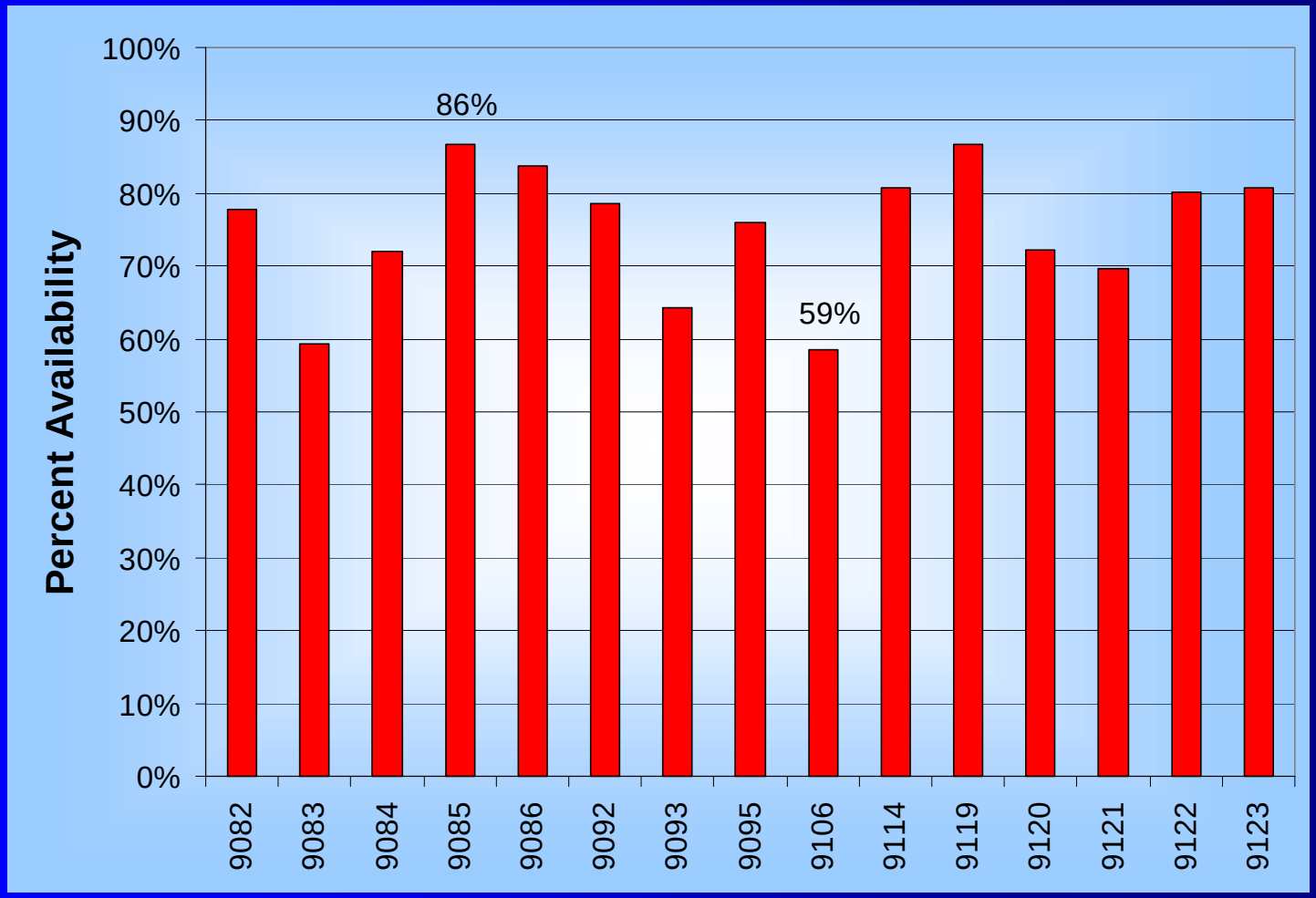
# PC25C Availability

## Lifelong Average for 15 Sites as of 3/31/02

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# Efficiency

At initial acceptance, power plants were required to demonstrate an output of 200 kW with a natural gas input of 1900 ±100 cubic feet per hour.

Electrical Efficiency LHV = 39% ± ~2%

HHV = 35% ± ~2%

***based on 925 Btu/cf (LHV) and 1027 Btu/cf (HHV)**

**- avg from 10 sites**

# Fleet Performance Summary

**(29 Power Plants)**
**As of 31 March 2001**

| | |
|---|---|
| • Total Run Time | 805,187 hrs |
| • Availability | |
| Model B Fleet | 57% |
| Model C Fleet | 75% |
| • Energy $ Saved | $5,640,298 |
| • NOx Abated | 264.0 tons |
| • SOx Abated | 559.1 tons |
| • CO Abated | 22.7 tons |
| • $CO_2$ Abated | 33,986.0 tons |

# Climate Change "Rebate" Program Objectives

- Reduction of Fuel Cell Prices via Economy of Scale
- Proactive Approach for DoD Involvement

# “Rebate” Program Highlights

- **Grant Money Available / Fiscal Year**

| | |
|---|---|
| FY00 | $ 2.0M |
| FY99 | $ 2.3M |
| FY98 | $ 4.2M |
| FY96/97 | $10.6M |
| FY95 | $ 8.2M |

- **Cost-Shared Program Incentives**

  $1,000 / kW up to 1/3 of the total cost

# Site Management System (SMS)

- **Multi-Unit Load Share**
  - Parallel Fuel Cell Installations
- **Seamless Transfer Capability**
  - Instantaneous Backup Support for Critical Loads
- **Field Demonstration - U.S. Post Office, Anchorage, AK**
  - Five ONSI PC25 Fuel Cell Power Plants

# Customer Needs

- U.S. Postal Services Main Processing Center in Anchorage Experienced Frequent Momentary Outages
  - Caused Shutdown of Mail Sorters
  - Elapsed Time to Clear and Restart-- 2 Hours
  - Lost Productivity and Time
- Concurrently, Facility Needed to Replace Back-up Diesel / Generator and Inadequate Ups System

# System Operational Parameters

## Electrical - Normal

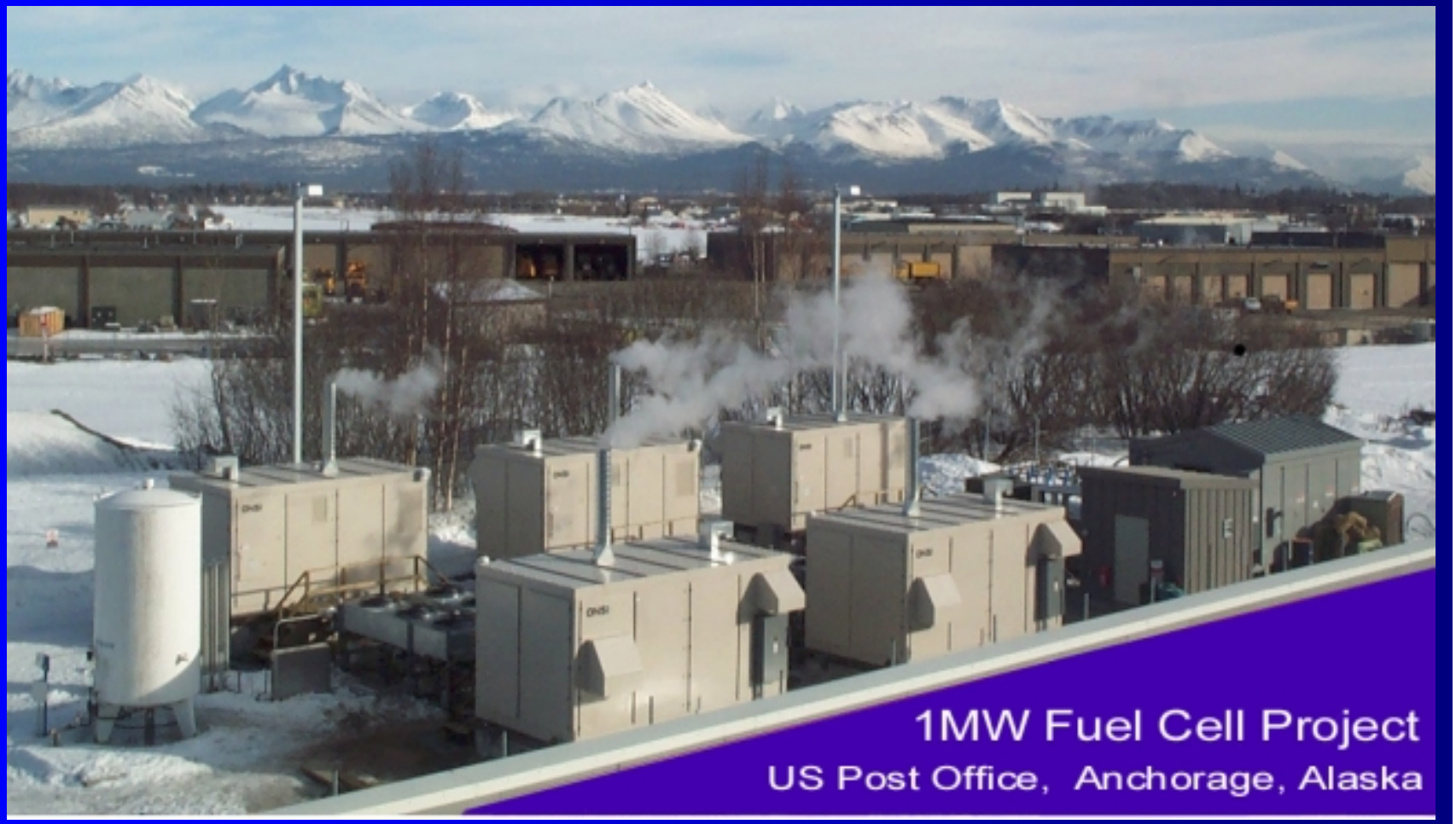
- Operates in Parallel to Grid
- Provides All Power to Facility (~ 800 kW Peak)
- Provides Excess Power to Chugach Grid

## Electrical - Grid Outage

- Operates Grid Independent; Provides All Facility Power
- Transfers Seamlessly (1/4 Cycle); No Equipment Outages
- Units Share Facility Load (Multi-unit Load Share Option)
- Replaces Existing Diesel Generator Set and UPS

## Thermal

- Provides Facility Heating With PC25 C High Grade Heat Option

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# FY01 Residential Fuel Cell Demonstration Program

- PEM Units, 1 kW to 20 kW
- US Military Facilities/Embassies, etc.
- Turn Key Packages Requested
- Maximum Diversity Desired
- 1 Year of “Fuel Cell Power” Required
- ~ $3M Available

# FY01 Residential PEMFC Demonstration Program

## SITE APPLICATION MATRIX

| Site Name | Building Application | Fuel Cell Manufacturer | Input Fuel | Size (kW) | No. Units | Cogen. Y/N |
|---|---|---|---|---|---|---|
| Sierra Army Depot | Barracks | H Power | Propane | 4.5 | 1 | Yes |
| Brooks AFB | Base Housing | DCH Tech. | Natural Gas | 3 | 3 | No |
| MCB Kaneohe Bay | Base Housing | Avista Labs | Propane | 5 | 1 | No |
| Ft. Bragg | TBD | Avista Labs | Natural Gas | 5 | 1 | No |
| Ft. Jackson | TBD | DCH Tech. | Natural Gas | 3 | 1 | No |
| Barksdale AFB | TBD | Avista Labs | Natural Gas | 5 | 1 | No |
| Patuxent River NAS | Office Building | H Power | Propane | 4.5 | 1 | No |
| Patuxent River NAS | Office Building | H Power | Natural Gas | 4.5 | 1 | Yes |
| Geiger Field | Office Building? | Avista Labs | Hydrogen | 3 | 1 | No |
| Watervliet Arsenal | Research Facility | Plug Power | Natural Gas | 5 (2.5) | 3 | No |
| Watervliet Arsenal | Manufacturing Facil | Plug Power | Natural Gas | 5 (2.5) | 3 | No |
| Watervliet Arsenal | Officer's Quarters | Plug Power | Natural Gas | 5 (2.5) | 4 | No |

# PEMFCs Installed at Watervliet Arsenal

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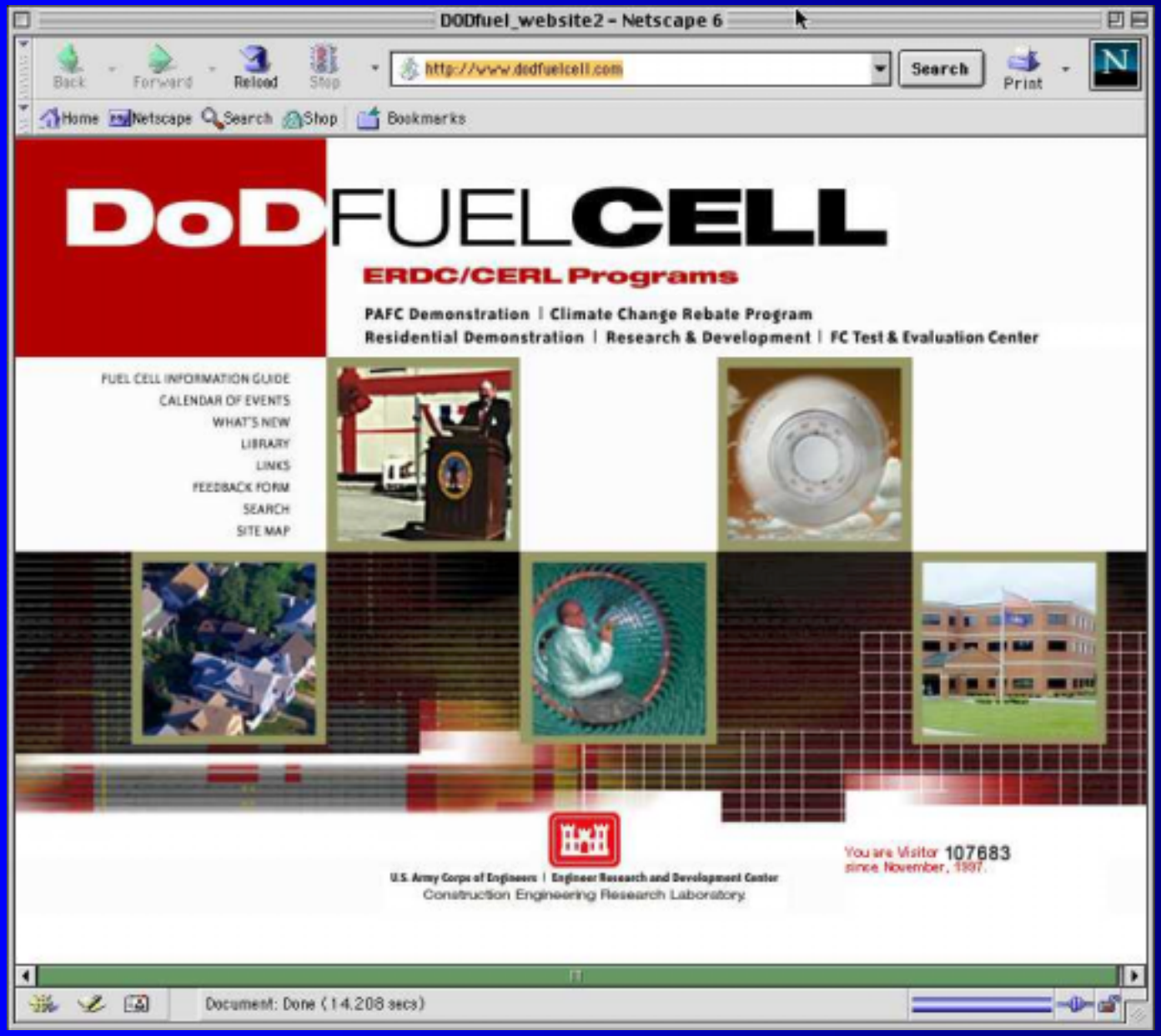
# www.dodfuelcell.com

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